

Lab Aims for “Small” Breakthroughs

The **Microanalytical Instrumentation Center** opens a new “clean room” designed to help it stay at the forefront of nanotechnology.

A new laboratory is helping researchers at IPRT’s Microanalytical Instrumentation Center shrink scientific instruments to microscopic size. The W. M. Keck Laboratory for the Fabrication of Microminiaturized Analytical Instrumentation is a “clean room” used to create a new generation of instruments with many advantages over their much larger predecessors. It was funded in part by the W. M. Keck Foundation of Los Angeles through a gift to the Iowa State University Foundation.

“This may be the only clean room for microfabrication in the country designed by and for chemists,” said Marc Porter, MIC director and an ISU chemistry professor, noting that most clean rooms are designed for making electronic devices. “Its main purpose is to assist in our quest to build microanalytical instrumentation.”

The new facility will play a critical role in the Combinatorial Discovery Initiative recently launched by ISU and MIC. This effort is aimed at applying massively parallel strategies to the discovery and high-throughput testing and screening of thousands of new target materials. The lab is also open to use by faculty and students from around the university as well as researchers from other universities and industry. “We support all phases of microfabrication and its use in fields ranging from chemistry and biology to zoology and genetics,” Porter said.

Tiny Valves and Pumps

The lab is on the leading edge of a fast-growing technology called micro-electromechanical systems, or MEMS, in which devices are made on the scale of hundreds or even tens of nanometers. Tiny components such as valves and pumps are etched onto materials such as silicon or plastic, much in the same way electronic devices are etched onto chips. These devices must be produced in a clean-room environment to keep out contaminants.

Rather than just making miniaturized components, however, researchers in the Keck Lab are working on analytical instruments and entire systems. “This field is now transitioning from ‘what can you miniaturize’ to ‘what can you do with it,’ and we’re focused on the latter,” Porter said. Applications for this technology range from entire analytical systems made for spacecraft to lab equipment that requires much smaller samples than traditional instruments.

“Indeed, the ability to greatly reduce the size of samples needed to produce satisfactory test results is especially important in medical and genomics applications,” Porter said. The amount of waste produced is also reduced, vastly easing disposal requirements. Moreover, like semiconductor-based electronic devices, these miniature instruments promise to be much more reliable and portable than traditional equipment. “Eventually, some of these devices may even be implanted into humans to evaluate and treat disease,” Porter said.

Now That’s Clean

Clean rooms are kept virtually free of contaminants by special ventilation systems. Air in the Keck Lab changes eight to nine times per minute. It includes areas for Class 10 (less than 10 particles, 0.5 microns in size, per cubic foot) and Class 100 clean-room facilities. The clean room area, totaling almost 1,000 square feet, houses equipment for photolithography, wet and dry etching, laser-based patterning, annealing, packaging and computer-aided design.

The Keck Lab draws on faculty and scientists from around ISU, bringing in expertise on micromechanics, microfluidics, biology, chemistry, physics and microelectronics. “It also functions as an invaluable education resource for undergraduate and graduate students, helping them develop microfabrication skills widely used in industry,” Porter said. He adds that the unique facility has already helped attract new faculty to ISU. ■



The W. M. Keck Laboratory for the Fabrication of Microminiaturized Analytical Instrumentation is a new “clean room” used to research the next generation of miniaturized devices.